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ABSTRACT

Two experiments in instructional supervision were conducted to support teachers in changing their teaching behavior as they implemented a new math curriculum. The focus of the investigation was a method of teaching multiplication and principles of effective teaching. In the first experiment, instructional supervision, both with and without inservice meetings, was provided for a group of teachers who were then compared with teachers who received no support (control group). The supervisor observed the lesson and led a feedback session which focused on problems experienced by the teacher and suggestions for resolving the problems. Analysis of the data on implementation of the curriculum indicated that teachers who attended inservice meetings covered more material and spent more time on the curriculum than teachers from the control group. Pupils of teachers in the experimental groups were able to solve multiplication problems on a higher level of abstraction than pupils from the control group. The second experiment examined the question of whether effects on implementation of the curriculum and pupils' achievement resulted from the instructional supervision alone or from a combination of instructional supervision and inservice meetings. Results indicated that instructional supervision did not have an effect on either the degree of implementation of the curriculum or on teachers' behavior. However, pupils from the experimental groups outperformed pupils from the control group on the test based directly on the content of the curriculum. (IAH)

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EFFECTS OF INSTRUCTIONAL SUPERVISION ON PUPILS' ACHIEVEMENT

Paper presented at the conference
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EFFECTS OF INSTRUCTIONAL SUPERVISION ON PUPILS' ACHIEVEMENT

Introduction

The use of instructional supervision in in-service training for teachers has been strongly advocated in the last few years. This technique involves the observation of teachers in the classroom while they teach by a supervisor. In a subsequent feedback-conversation between teacher and supervisor, discrepancies between the observed and the desired behavior are discussed and recommendations for improvement are made. The underlying assumption in the use of instructional supervision is that the way teachers teach can be improved only by providing direct feedback to a teacher on aspects of his or her teaching (Boydell, 1986).

The ultimate goal of instructional supervision is, however, for changes in teachers' behavior eventually to lead to an improvement in pupils' achievement.

The question for research is therefore whether this goal can be achieved using instructional supervision. In other words: what is the effectiveness of instructional supervision as means of changing teachers' behavior and hence pupils' achievement.

Experimental research in this domain is rather scarce. Some experiments have been carried out on the use of instructional supervision. In these experiments instructional supervision has been used in combination with in-service meetings. The effects of these training activities on the implementation of an innovation c.q. curriculum and on pupils' achievement have been examined (Miller & Ellsworth, 1985; Stallings, 1985; Gersten et al., 1986; Taylor et al., 1986). In these experiments it appeared that instructional supervision in combination with in-service meetings can have a positive effect, both on the implementation of an innovation and on pupils' achievement. It was however,

not clear in what way the instructional supervision occurred or which element in the training activities could be considered responsible for the positive effect. An experiment in which the two training activities, in-service meetings and instructional supervision, are systematically varied is required to determine this.

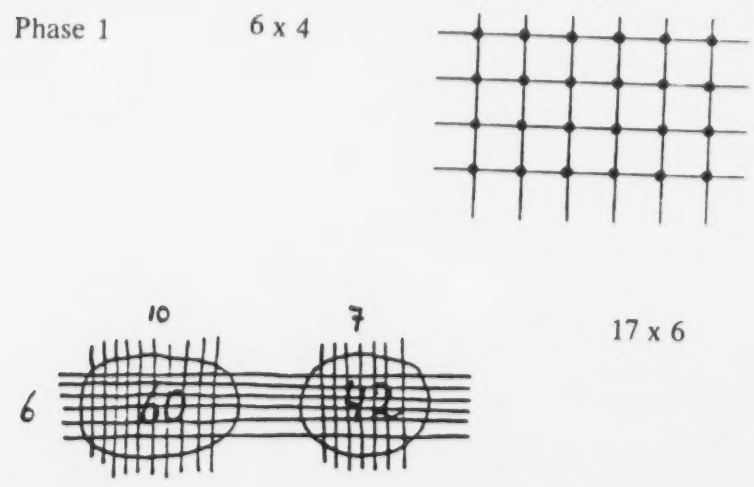
In this paper two such experiments will be discussed. In these experiments instructional supervision was used to support teachers in changing their teaching behavior in order to implement a new math curriculum. The curriculum involved both a new way of teaching multiplication and principles of effective teaching.

This paper will concentrate on the effectiveness of instructional supervision - both alone and in combination with in-service meetings- in producing a change in teachers' behavior and an improvement in pupils' achievement.

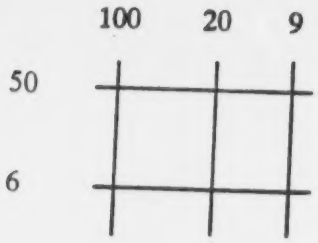
Method

In the experiments teachers from the fifth grade of elementary school (i.e. children in the age of 8 and 9 years) implemented a new curriculum in multiplication. This curriculum was constructed according to new insights into the didactics of mathematics, the so called realistic mathematics. This means, among other things, that schemata are used to teach the multiplication algorithm. The schemata are rather extensive at the beginning of the learning process. They become more abstract and shorter towards the end of the process and are finally condensed into the standardized algorithm for multiplication, which is the highest level of abstraction in solving a multiplication problem. (see fig. 1 for an outline of such a learning process).

Fig. 1: Phases in the learning process of multiplication



Phase 2 129 x 56



33 x 48

	30	3
40	1200	120
8	240	24

Phase 3 187 x 65

	187
65	
	35
	400
	500
	420
	4800
	6000
	—+
	12155

187
65
—x
35
400
500
420
4800
6000
—+
12155

Phase 4

187
65
—x
935
11220
—+
12155

The role of the teacher is to encourage pupils and stimulate them to find more concise ways of solving multiplication problems. This is a form of interactive teaching, which is considered to be rather new to most teachers who are used to teaching with traditional arithmetic methods. In the traditional arithmetic methods teachers have the more active role in teaching a new subject-matter and the role of pupils is restricted to listening and absorbing. Teachers who want to use the new curriculum have therefore to make rather drastic changes in their teaching behavior in order to implement the curriculum in the right way. In order to provide support for teachers while they were in the process of implementing the new curriculum, instructional supervision -with or without in-service meetings- was provided for a group of teachers. Teachers in this group were then compared with teachers who received no support while implementing the curriculum (control group). A pretest-post-test-controlgroup design (Cook & Campbell, 1979) was used to

collect empirical evidence on the effectiveness of instructional supervision as a means of supporting teachers in changing their behavior.
The effects of the training activities for teachers were assessed by determining the extent to which they actually implemented the curriculum and by measuring the results of the pupils. Extent of *implementation* of the curriculum was operationalized as the amount of curriculum content actually covered in the lessons and the degree of conformity between observed teaching behavior and the teaching behavior prescribed in the curriculum.
The *pupils' achievement* was measured with two different arithmetic tests: a curriculum-specific test which contained multiplication problems based on the content of the curriculum and a standardized achievement test measuring ability in mathematics in general. The latter test was used to compare pupils in the experiment with a random group of pupils. These tests were administered prior to the experiment (pretests) and afterwards (post-tests). The test scores of the pupils in the experimental groups and the control group were analyzed, using analysis of covariance, to see if any differences between the groups could be attributed to a difference in teacher training. Apart from the test scores of pupils, the strategies they used in order to come to the solution of a multiplication problem were also analyzed. These strategies - operationalized as the phase of the learning process in which the pupils came to a solution, as illustrated in the phases in fig. 1- provided an indication of the way in which the teachers had given the instruction.

Experiment one

In the first field-experiment a comparison was made between the use of instructional supervision in combination with in-service meetings, in-service meetings alone and no support. There were 30 teachers who participated in this experiment.
The *in-service meetings* were held to give teachers the opportunity to exchange experiences with colleagues from other schools who were implementing the same curriculum and to discuss problems. During these meetings the lessons were discussed and prepared in accordance with the manual. Teachers received background information on both the curriculum and mathematics education in general. In total, five such in-service meetings were conducted by the instructional supervisor involved in the research project.
The *instructional supervision* was also provided by this supervisor. Teachers were observed while teaching a lesson from the curriculum and their behavior was compared with the behavior prescribed in the curriculum. Afterwards the lesson was discussed with the teacher. If there were discrepancies between actual and prescribed behavior the supervisor provided the teacher with

suggestions for a change of behavior.
The process of instructional supervision can best be described by indicating the role of the supervisor. The supervisor observed the lesson and lead a feedback session in which any problems experienced by the teacher were identified and concrete suggestions as to how they can be overcome were provided. A crucial feature of this method was that the supervisor observed the lesson without intervening. She did not take over the lesson during the observation. In this experiment the supervisor visited the teachers twice.
From the results it appeared that the instructional supervision as performed in this experiment concentrated mainly on problems in the instructional and management behavior of teachers. In table 1 a review of the content of the instructional supervision and the amount of time spent on each subject is given for all 13 teachers who received instructional supervision

Table 1: Review of subjects in instructional supervision and the percentage of the total time spent on each subject (experiment 1)

Instruction:	
- interactive nature of instruction	11 %
- content of instruction	27 %
- technical aspects concerning the phases in the learning process	8 %
Individual seatwork:	
- discussing assignments for seatwork	16 %
- giving tasks for seatwork	8 %
Organization of the lesson:	
- time management	11 %
- planning of curriculum content	8 %
- management behavior	11 %

The analysis of the data on the implementation of the curriculum showed that teachers who attended in-service meetings covered more material and spent more time on the curriculum than the teachers from the control group. The pupils of the teachers in the experimental groups were also able to solve

multiplication problems on a higher level of abstraction than the pupils from the control group.
As a consequence of this, the scores of pupils in both experimental groups were higher than the scores of the control group, as is shown in table 2.

Table 2: Average pre-and post-test scores of pupils (on classroom level) and standard deviations (experiment 1)

	RION* pretest (10 items)	RION post-test (15 items)	CITO** pretest (40 items)	CITO post-test (40 items)
Experimental group 1: in-service meetings and instructional supervision (n= 13)	4.6	8.0	28.8	26.5
	(1.4)	(2.4)	(4.0)	(4.2)
Experimental group 2: in-service meetings (n= 10)	4.6	6.4	29.2	23.4
	(1.5)	(2.8)	(2.5)	(3.8)
Control group (n= 6)	4.1	5.4	28.3	23.1
	(0.8)	(3.2)	(3.9)	(4.5)
Norm group pretest (n= 687 pupils)			31.5	
			(7.1)	
Norm group post-test (n= 852 pupils)				24.9
				(7.8)

* RION-test is the curriculum-specific test, based on the content of the curriculum.

** CITO-test is a standardized achievement test.

These differences are statistically significant, as is shown by the results of an analysis of covariance, both on the curriculum-specific test ($F(2,22)=3.47, p<.05$) and on the standardized test ($F(2,22)=8.10, p<.01$). In

this analysis the pretest scores on the standardized test were used as covariate. There were no differences between the three groups on the pretests.
This effect was stronger for the group of teachers who received instructional supervision as well as in-service meetings. Observational data showed that teachers who received training exhibited more behaviors in congruence with the goal of the curriculum than did teachers from the control group. In this respect there appeared to be no difference between the teachers who attended in-service meetings and received instructional supervision and those who only attended in-service meetings.

The next field-experiment was intended to determine whether effects on implementation of the curriculum and on the pupils' achievement were the result of the instructional supervision alone or the combination of instructional supervision and in-service meetings.

Experiment two

In the second experiment two experimental groups were formed. One group received only instructional supervision. The supervisor visited the teachers in the classroom four times to observe and discuss their behavior. The other group both received instructional supervision and attended five in-service meetings. Both the instructional supervision and the in-service meetings were similar to the ones in the first experiment.
During the instructional supervision much attention was given to the subject of interactive instruction. In table 3 a review of the subjects discussed during the instructional supervision and the percentage of the total time spent on each subject is given. In total, 21 teachers from the two experimental groups received instructional supervision.

Table 3: Review of subjects in instructional supervision and the percentage of the total time spent on each subject (experiment 2)

Instruction:	
- interactive nature of instruction	20 %
- content of instruction	26 %
- technical aspects concerning the phases in the learning process	12 %
Individual seatwork:	
- discussing assignments for seatwork	12 %
- giving tasks for seatwork	6 %
Organization of the lesson:	
- time management	9 %
- planning of curriculum content	7 %
- management behavior	8 %

The results of the experimental groups on the implementation of the curriculum and the pupils' achievement were compared with the results of a control group of teachers who did not receive any support while implementing the curriculum.

The results show that instructional supervision did not lead to improved implementation. All teachers gave the same number of lessons on the curriculum and spent an equal amount of time on these lessons.

There was also no difference in teaching behavior between the teachers from the experimental groups. A comparison with the teaching behavior of the teachers from the control group was not possible, because there were no observational data available for this group. It did appear, however, that the pupils from the experimental groups solved multiplication problems on a higher level of abstraction than the pupils from the control group. With respect to the pupils' achievement, the pupils from the experimental groups outperformed the pupils from the control group on the test based directly on the content of the curriculum. This difference in achievement is statistically significant, according to the results of an analysis of covariance, performed

with the standardized pretest score as covariate ($F(2,29)=5.25, p<.01$). On the standardized achievement test the difference between the experimental groups and the control group almost reached statistical significance ($F(2,29)=2.84, p=.08$). The pupils from the three groups did not differ from each other on the pretests. The test results are shown in table 4.

Table 4: Average pre-and post-testscores of pupils, (on classroom level) and standard deviations (experiment 2)

	RION* pretest (10 items)	RION post-test (23 items)	CITO** pretest (40 items)	CITO post-test (40 items)
Experimental group 1: instructional supervision and in-service meetings (n= 11)	3.8 (1.9)	6.5 (2.6)	24.0 (5.7)	25.6 (6.1)
Experimental group 2: instructional supervision (n= 13)	4.4 (1.4)	6.0 (3.2)	26.2 (4.0)	25.3 (3.8)
Control group (n=15)	4.3 (1.4)	3.6 (2.2)	24.4 (4.6)	23.0 (4.3)
Normgroup pretest (n= 687 pupils)			31.5 (7.1)	
Normgroup post-test (n= 852 pupils)				24.9 (7.8)

* RION-test is the curriculum-specific test, based on the content of the curriculum.

** CITO-test is a standardized achievement test.

The conclusion from this second experiment must be that instructional supervision did not have an effect on either the degree of implementation of

the curriculum or on the teachers' behavior. However, the differences in achievement between the experimental groups and the control group suggest that there may have been a difference in teachers' behavior between the experimental groups and the control group. This difference could not be investigated with the available data. The fact that pupils from the experimental groups made more use of short solutions to multiplication problems is also an indication of a higher degree of implementation of the curriculum in the experimental groups.

In a *follow-up study* seven months after the second experiment was completed another measurement of pupils' achievement was made to determine whether the differences between the groups had been maintained. From the analysis of the test results it appeared that there were no persisting differences in achievement between pupils from the experimental groups and pupils from the control group. There was, however, one exception. On a subtest of the curriculum-specific test concerning ability in estimation, pupils from the experimental groups again scored higher than pupils from the control group.

Discussion

In the experiments reported here, instructional supervision concentrated mainly on the instructional behavior of teachers. Organisation is another important area of teachers' behavior which requires improvement. It includes aspects which are of great importance when it comes to improving pupils' achievement, such as time management, planning of content to be covered and classroom management.

The results from the two experiments do not provide unequivocal support for the effectiveness of instructional supervision in improving both the implementation of a curriculum and pupils' achievement. Although the first experiment provided evidence for the effectiveness of instructional supervision, these results were not confirmed in the second experiment. However, there are indications in the way pupils solved multiplication problems which point in that direction.

The results suggest that in future research on instructional supervision as a factor affecting pupils' achievement it is important that the evaluation of pupils' test results also includes the strategies pupils use to solve the problems, as an indicator of the learning process that has taken place.

Furthermore, future research on instructional supervision is necessary to determine if its effectiveness can be established in some other way and to search for explanations for the effect of instructional supervision. This research is important, particularly in the Dutch situation, because many regional centers

of support subscribe to the importance of instructional supervision and are making increasing use of this technique.

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